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Laboratory Manual

The intent of this manual is to include in one document all of the directives and instructions that have been issued to the testing laboratories since the inception of the IGCC and IGMA certification programs. These instructions are intended to clarify, and supplement testing conducted in accordance with the currently adopted releases of ASTM E 2188-19, ASTM E 2189-19, ASTM E2190-19, ASTM E546-14(2020) and ASTM E2649-20.

Although this document is believed to reflect the most up to date information on the date of latest revision, the IGCC®/IGMA® certification programs are dynamic and ever changing. We will continue to issue letters of instruction to the testing laboratories that add or delete from the instructions contained herein.

We welcome your constructive comments and hope that you will not hesitate to advise us of any suggestions that may make this a more effective document.

NOTE Regarding 2019 ASTM E2188, E2189, E2190 Revisions (As determined at the May 2019 IGCC Meeting):

To adopt the 2019 versions of ASTM E 2188, 2189 and 2190 for certification and testing in the IGCC/IGMA Certification program. Testing to the 2010 version of the standard shall be considered equal to testing to the 2019 version of the standard except for the supplemental internal component testing. Initial sample fabrication for supplemental internal component testing shall not require auditor witness. Testing to the 2019 version of the standard shall begin on or before 1/1/2020 and certification (listing) to the 2019 version shall begin August 2020.

This Manual is divided into the Following Sections

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A. Communication, Administration and Reporting

- A.1 **Communication-** Upon fabrication, test specimens become the property of the certification program. As such, the laboratory's client and all communication by the lab shall be directed to the administrative office. In situations such as facilitating shipping of test samples, testing schedules, or condition of units, the lab should feel free to communicate requested information to the licensee. For all other matters, communication shall be directed to or with the consent of the administrative office.
- A.2 **Damaged units-** Any damage to specimens is to be noted on the "Notice of Test Specimen Fabrication" form. The laboratory should identify if the units are in a condition suitable for testing. When any question exists as to the suitability for test of damaged units or the entire set of units, the laboratory shall notify the administrative office who, in turn, shall seek the direction of the program participant. Units with any damage (glass or shipping) should only be used as a last resort and only with the authorization of the administrative office. It shall be noted that ASTM E2190 section 6.4 makes reference to units with "visible deposits" not being "qualified". This was intended to only apply to volatiles condensed during the fog test and does not apply to blemishes present prior to exposure (i.e. finger prints, coated glass corrosion). The same blemishes present before and after exposure shall only be a condition of failure if the blemish effects the pass/fail criteria.
- A.3 **Distribution of Test Reports and Test Billing-** Testing fees shall be invoiced to and paid by the administrative office and reports sent to the administrative office and to no one else.
- A.4 **Professional Engineer-** Testing shall be done in accordance with certification program guidelines, the applicable test standards, and this manual. Testing shall be reviewed by a professional engineer and each test report shall bear his/her seal and signature.
- A.5 **Identification-** All reports, correspondence and invoices shall reference the specific certification number and the applicable certification period (IGCC®/IGMA® XXXX L09).
- A.6 **Monthly Status Reports-** All information requested on monthly status reports shall be updated and forwarded to the administrative office by the 10th of each month. This information shall include an estimate of completion of testing for each stage.
- A.7 **Additional Testing-** On occasion, program participants may request testing beyond normal certification program requirements. In such cases, release of the units must first be obtained from the administrative office. The laboratory may then provide services as requested, but the certification program shall have no responsibility, including fees, for such additional work. In some cases, release of the units must first be obtained from the administrative office. An example of additional test may include an exact Frost Point. This may be completed but communication is between the Client and Laboratory and may include additional fees.

- A.8 **Selection of Testing Laboratories-** Each certification program participant indicates to the Administrator which testing laboratory they prefer for each product at each plant. In virtually every case, the Administrator is guided by the request of the participant.
- A.9 **Test Fees-** Laboratories are contracted directly with the certification program and all testing invoices shall be paid by the administrative office. Each year the laboratory will be requested to provide the fees they will charge for the following year and invoicing and payments shall be in accordance with these pre-determined fees. The Administrative office shall publish and make available to interested parties a fee schedule for all approved testing laboratories. While in concept IGCC®/IGMA® encourages laboratories to provide testing at the lowest cost possible, one of the underpinnings of the certification program is that all participants are treated equally. For this reason, all certification testing fees will be by the published fee schedule and discounts or rebates of any kind for individual participants will not be allowed.
- A.10 **Authorization to Test-** The laboratory will be provided with an authorization to test form for each product. The applicable test is “authorized” when this form is initialed and dated by the administrative office. This is essentially an indication that the fee for testing has been collected from the participant. It is acceptable for the laboratory to start testing prior to receiving the initialed authorization, but in these cases IGCC nor IGMA will not be financially responsible for the test until authorization is provided. Unless otherwise waived, per ASTM E2188 par. 7.2, testing shall not be started prior to 4 weeks from fabrication date.
- A.11 **Observation of Failed units-** When a test failure is experienced, a participant will routinely look to the laboratory to make observations of the condition of the failed unit. IGCC supports any assistance the laboratory may provide and will facilitate if appropriate but will not assume any technical or additional financial responsibility.
- A.12 **Sealant Dimensions-** Regarding reporting sealant dimensions, per ASTM E2188 paragraph 10.1.11 “**Sealant Type (s) and dimensions, if provided**”, shall be interpreted that this information shall only be reported if “provided” by the fabricator to the laboratory and verified by the laboratory.
- A.13 **ISO Guide 17025 Compliance-** A condition of laboratory approval shall be that the laboratory shall provide written documentation from a qualified independent third-party organization that states compliance with the ISO 17025 requirements. IGCC and IGMA view “qualified independent third-party organizations” as either: IAS, A2LA, NVLAP, or SCC. Other organizations who have memorandums of joint recognition with any of these organizations may also be acceptable.
- A.14 **Maximum Testing Time** – The laboratory will maintain a maximum ten-month turn around period from time of receipt of test units unless delayed by conditions not in the Laboratory's control, e.g. licensee authorization to proceed or breakage.

B. Specimen Handling and Storage

- B.1 **Cost of Shipping** - Shipping and delivery of test samples to the testing laboratory, and all costs associated with, is the responsibility of the certification program participant. All samples should be delivered “pre-paid”. If other arrangements need to be made, it shall be at the discretion of the testing laboratory. IGCC, IGMA nor the administrative office shall have no responsibility for the cost or arrangements of shipping and delivery of test units.
- B.2 **Storage of Unit-** Store and mount all specimens in the vertical position so that both lites of the assembly are supported and therefore not in a shear condition. All precautions should be taken to ensure no metal to glass contact during all stages of storage, handling and testing. Precautions should also be taken to ensure seal systems are not in contact with material that they may adhere to. It is best to place units on some form of setting blocks in the vertical position during all stages of storage, handling and testing.
- B.3 **Retention of Units-** Passing samples are to be kept for 30 days from the date of final test report. Non-compliant samples shall be kept for 90 days from the date of the final test report. **Samples include all specimens sent in for testing (including any additional non-tested specimens). Broken specimens may only be disposed after fabricator approval.**
- B.4 **Marking of units-** Under no circumstance should the testing samples be etched or scratched for identification purposes. If the lab wishes to mark test units for identification purposes, an indelible marker, tape or other non-destructive method should be used.
- B.5 **Testing of Additional units-** Laboratories may, at their discretion, perform weathering testing on more than the required six specimens. When this is done, the first six test specimens listed on the report shall be considered the test specimens for purposes of determining compliant results. The remainder of test specimens shall be considered as spares. **In the case of thermal breakage, up to two spares may be used to replace the broken specimens. The replaced units must go through all phases of testing, and if there are more than two broken specimens the test will be determined as non-compliant (As written in ASTM E2190-02). Additional fees for use of spare units in the case of thermal breakage are at laboratory discretion and must be communicated to participants prior to commencement of testing.**
- B.6 **Return of units-** There may be conditions where the certification program participant wishes test units be returned. This most often occurs after the observation of non-compliant results. In general, the laboratory should make every effort to accommodate such requests. Authorization to return test units must be received from the administrative office prior to release. The certification program participant shall be responsible for any additional charges for the return of test units.

- B.7 **Receipt of test samples** – Specimen crates shall be opened, and test units inspected for damage no later than 5 business days from receipt. Corresponding paperwork shall be matched to the glass samples received and relevant information identified. The “IGCC Notification of Test Specimen Fabrication” form and the “IGCC Laboratory Monthly Status Report (MSR) & Authorization to Test” forms shall be completed and returned to the IGCC office. See documents attached for examples.

C. Testing and Equipment Operation

- C.1 **Testing-** All certification testing shall be done in accordance with certification guidelines, ASTM E2190 and associated standards and this manual.
- C.2 **Data Logging** - A continuous temperature chart or data logging device must be maintained for equipment operation for both the high humidity (HH) testing and the accelerated weathering (AW) testing. This must be at least a 7-day chart or log. All charts or logs must be identified with the applicable laboratory chamber and the date or week of the year. Charts or data logging must be digital with no greater than a 5-minute interval and provide clear real time values for time and temperature, and to a level of accuracy that will allow determination that standard conditions were met.

While continuous logging is recommended for the ASTM E2189 fog chamber(s), it is not required. A daily manual log is acceptable (see C.3). Means must exist to verify real time values.

Record Retention – Charts and/or operation logs must be maintained, current and historic, for at least 2 years.

- C.3 **Operational Logs-** Realizing that tests are conducted on a 7-day around the clock basis, once each day for a five-day week, check and keep written records of the following information that is not otherwise automatically recorded or logged. This log must be completed thoroughly and include technician initials or signature. (This “visual check” log is not intended as a substitution for annual calibration, see C.7):
- Moisture, humidity or RH is present or at required values
 - Temperature recording is operational, and values correct
 - AW cycle is correct
 - All UV bulbs are functional including fog lamp
 - Fog chamber parameters

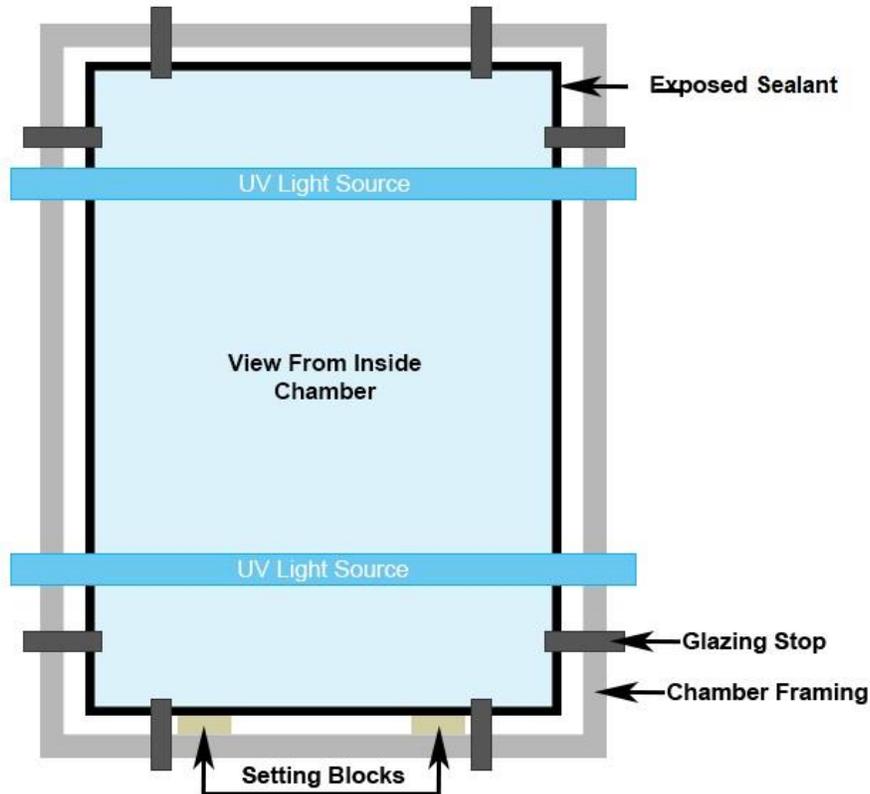
Record Retention – Operating logs must be maintained, current and historic, for at least 2 years.

- C.4 **UV Bulb Readings-** UV output of each bulb shall be measured at least annually. With the specified range of UV light output established in ASTM E2188-2019, UV output shall be measured frequently enough to ensure testing in accordance with the requirements of the standard.

- C.5 **AW Chamber Stratification-** At least annually, the accelerated weathering (AW) chamber shall be checked for balance or stratification. This shall be done by recording separate temperatures in the chamber, as a minimum (1) upper right (2) upper left, (3) center (4) lower right (5) lower left and ensuring these individual temperatures are within the tolerances as stated in the appropriate standard.
- C.6 **Minimum Frost Points-** Measure and record actual frost points if warmer than -60°F (-51°C). (actual frost points are optional, if below -60°F, < -60°F is acceptable).
- C.7 **Calibration-** Calibration of all measuring and recording devices shall be performed at least annually.
- C.8 **RH requirements-** delete 12-14-2017 (Requirements are included in the ASTM E2188 standard).
- C.9 **Fog Chamber Water Temperature-** ASTM E2189 paragraph 6.1.6 shall be interpreted that the temperature of the cooling water should be measured just as it exits the plate, not down stream outside the box. This interpretation has been confirmed with the ASTM committee and will be clarified in subsequent versions of the standard. The concern is to ensure no significant heat gain from plate outlet to box outlet. If it can be shown that both temperature locations are within tolerance, measurement at either location will be acceptable. Temperature measurement points should be shielded from radiant heat.
- C.10 **Frost Point Determination-** A) ASTM E2190 – 2002 paragraph 4.3 allows for frost points to be determined at various times between 1 and 7 days. If multiple frost points are taken and result are different readings, the correct frost point shall be interpreted as the lowest in the 7-day period. The current standard does not include this reference, but the 2002 practice shall apply to all IGCC/IGMA testing. If the frost point is failing prior to 7 days, it shall be required to re-frost point the unit at 7 days.
- B) The stabilization times listed in ASTM E546 do not speak to glass thicker than ¼-inch (6mm). As of 9/2019 no written directive could be located but in consultation with industry experts, for frost point determination it is suggested to use 8 minutes for >6 to 8 mm and 12 minutes for glass greater than 8mm, or laminated glass. Additionally, 5/32-inch (4mm) falls between 3 and 4 minutes. The more conservative 4-minute time should be used for 4mm.

Glass Thickness Designation		Stabilized Temperature Duration
1/8 in	2.5 mm	3 min
1/6 in	3.0 mm	3 min
5/32 in	4.0 mm	4 min
3/16 in	5.0 mm	4 min
1/4 in	6.0 mm	5 min
5/16 in	8.0 mm	8 min
> 5/16 in	> 8.0 mm	12 min

- C.11 **Fog Test Units-** When testing specimens with internal components air space material (IC) muntins, grills or other, currently 3 test units are fabricated with the IC (5 for triple pane units). These 3 (or 5) units shall be the units exposed to the fog test.
- C.12 **Capillary or Breather Tube Units-** When testing units that include capillary or breather tubes, the participant must supply directions for proper installation or orientation of the units. If such directions are not provided, the administrative office should be contacted.
- C.13 **HH Chamber Humidity Sensor –** When it can be demonstrated that a steam bath in the HH chamber can maintain 95% RH at the 140F, it is not necessary to maintain continuous RH monitoring. In this situation, the presence of humidity/moisture should be logged daily (see C.3). Re-validation of RH shall be done as part of annual calibration.
- C.14a **Fog Test Procedure –** delete 12-14-2017 (Procedure is included in the ASTM E2189 standard)
- C.14b **Fog Test Low-E Reporting-** Testing Laboratory shall include an indicator on the specimen(s) within the test report, to identify orientation of the low-e surface to the cold plate.
- C.15 **UV Meter –** deleted 5-8-2019
- C.16 **Fog Box Thermocouple Shielding** – ASTM E2189 section 6.1.5 requires “radiation-shielded thermocouples”. This shielding shall be of a similar reflective surface as the interior of the box.
- C.17 **Installation of IG Units in AW Chamber –**
- 1) 4th Corner Patch – A unit with a 4th corner patch shall be mounted such that the patch is not in contact with a setting block.
 - 2) In the absence of specific direction from the IG fabricator as to the orientation of test units, penetrations or connection points (keys, joiners, 4th corner patch/connects, other) should be oriented toward the top of the unit when testing.
 - 3) Visibility of seal lines – All seal lines must be exposed to the UV light source, except for small (less than 2”) glazing stops (see diagram).



Note: Approximate position of components for illustration purposes only, unit orientation may be vertical or horizontal.

- C.18 **Protective Devices** – Earlier versions of the ASTM standards required protective devices to be installed on the AW and HH chambers. Although this reference has been removed from the 2019 ASTM standard(s), the requirement will be maintained by IGCC to 1) protect the safety of personnel and facilities and 2) to protect the exposure of test units. Protection of the accelerated weathering chamber and the high humidity chamber from overheating and overcooling must be done with a proactive shut down device.
- C.19 **Volatile Fog Examination Light Source** – ASTM E2189-2019 states that the examination light source shall have a luminous flux of 1000-1400 lumens, and a color temperature of 4000-4200K. IGCC does not require these values to be measured as long as bulb specifications are reviewed and available. Based on an IGCC review, the GE Cool White Ecolux T12 bulb specifications state a nominal luminous flux of 1150lm and a color temperature of 4100K. The Philips Cool White F20T12/CW bulb specifications state a nominal luminous flux of 1200lm and a color temperature of 4100K. The Westinghouse Cool White F20T12/CW bulb specifications state a luminous flux (brightness) of 1200 lumens and a color temperature (light appearance) of 4100K.
- C.20 **Discontinuity in Testing** – ASTM E2188 section 8.5 states any discontinuity or stoppage in testing shall be recorded ... It is further clarified that when testing

comes “off cycle” the testing should be stopped, corrective action taken, and testing resumed to accomplish the required exposure.

- C.21 **Laboratory Technician Training-** Per the minutes 5.4.22.3 Certification Committee meeting, it is mandated that any technicians either signing IGCC/IGMA test reports, or performing IGCC/IGMA testing, are required to take and pass (100%) the IGCC Laboratory Interactive Animation Training exam. Annual participation in this training is required. (revised 5/4/2022)
- C.22 **Failure During Testing-** If a unit, or set of units, is deemed to be a failure prior to the completion of testing, the laboratory shall notify IGCC®, at which point the participant will be notified and provide guidance on whether testing should continue or be stopped. The laboratory should continue the testing of failed units unless directed otherwise by IGCC®.
- C.23 **Equipment Status-** (This includes equipment operational status, capacity) If any of the weathering equipment involved in ASTM E2190 testing (Accelerated Weathering chamber, Fog Box, High Humidity Chamber, etc.) experiences downtime greater than 2 weeks, or equipment capacity is reduced, the laboratory shall notify IGCC® within 2 working days.

D. Gas Content Initial and After Weathering (GCIA) Testing

- D.1 **Gas Test Procedure-** ASTM E 2649 "Standard Test Method For Determining Argon Concentration in Sealed Insulating Glass Units using Spark Emission Spectroscopy" shall be the governing procedure when testing gas content (GCIA).
- D.2 **GCIA Test Units-** All test units shall be gas filled with argon. All triple pane units shall have both cavities filled and tested. The test lab shall randomly select ten (10) units for initial gas content (If submitting samples for RAC testing the test lab shall randomly select an additional six (6) units for initial gas content testing) except that units containing internal components (IC) (i.e. grills or muntins) shall not be considered for testing. Units shall be inspected for any damage, and any damaged units not used. Testing for gas content after weathering shall be performed on the 6 weathering test units (If applicable, testing for gas content after RAC testing shall be performed on the additional 6 RAC test units).
- D.3 **GCIA Production units-** Deleted 5-6-2014
- D.4 **GCIA Values-** Laboratories shall report results of testing as “percent initial gas content” and “percent after weathering gas content” to the nearest whole percent. The calculation of percent initial gas content of the ten (10) test units (and, if applicable, the additional six (6) RAC test units), shall be the average of all 10 units tested (and, if applicable, the average of six (6) additional RAC test units). The calculation of percent after weathering gas content shall be the average of all 6 weathered test units. If applicable, the calculation of percent after RAC testing gas content shall be the average of all 6 RAC test units.

- D.5 **Gas Content of Units with IC-** At present units with IC are not considered for GCIA certification testing,
- D.6 **Gas Content Multiple Cavity** – The gas concentration of a multiple cavity IGU will be the average gas concentration of all the cavities to the nearest whole percent.
- D.7 **Acceptable GCIA Gas Testing Devices –**
1. The following devices are acceptable for IGCC/IGMA GCIA Gas Certification Testing:
 - a. Sparklike Handheld (Gasglass)
 - b. Sparklike 1002 (Suitcase)
 2. Non-destructive devices with accuracy equal to or better than Sparklike Handheld shall be acceptable for IGCC/IGMA Certification Testing as approved by the gas certification subcommittee.

Laboratory Manual Revision List	
Revision Date (authorization)	Revisions
2-3-09 (IGCC IGMA Agrmt)	Revisions to address one program, IGCC®/IGMA®
7-29-09 (Fog Test Comm)	Guideline C14 and Attach A, Add new Fog test Info
8-28-09 (Appeals Comm)	Guideline D.1 Added ref to new SES gas test procedure
9-17-09 (Board)	Guideline A.9 - Revise Lab billing procedures
10.28.09.11 (Cert Comm)	Attach A, Rev view distance and remove ref to reflectance
5-6-2014 (Cert Comm)	Guideline A.2, C.2, C.10, C.15, C.16, D.2, D.3, D.4, D.5 (delete attachments)
1-30-2018 (Cert Comm)	Added Guidelines A.14, B.7, C.17, C.18
1-30-2018 (Cert Comm)	Update Guideline A.11, C.2, C.3, C.8, C.14
9-26-2018 (Cert Comm)	Revise A.12
5-8-2019 (Cert Comm)	C.4, C.10, C.15, C.17, C18, C19, C.20, D.6, D.7
2-3-2020	Updated contact email address
4-27-2021	Guideline C.21 Added to affirm annual IA Lab Training Added ASTM standard dates to cover page
5-4-2022	Guideline C.22 Direct labs on handling failures that occur during testing and C.23 on equipment downtime (see IGCC Certification meeting min 5.4.22.2) C.21 updated to include either signing or performing IG testing
5/17/2023	Guideline B.3 Updated to include definition of 'Samples'. Guideline B.5 Updated to include thermal breakage. Added Guideline C.14b Fog Test Low-E Reporting.



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IGCC NOTIFICATION OF TEST SPECIMEN FABRICATION

TO: IGCC APPROVED LABORATORY, ###

Laboratory Name
 123 Testing Street, Suite A
 Sackets Harbor, NY

PARTICIPANT NAME: ABC Glass, Inc.
 PLANT LOCATION: Anytown, NY
 IGCC NUMBER: 1234 F22

FABRICATION DATE: 4/15/2022
 SELECTED BY: Auditor ID #
 TEST METHOD: E2190

Please be advised the above mentioned product has been fabricated for testing. The IGCC Licensee has indicated they will ship samples to your laboratory within four (4) weeks from the date of fabrication. Upon receipt, please complete below information and return form to IGCC. Thank you for your cooperation.

DATE UNITS RECEIVED: _____

If specimens are not received by ###/###/2022, please contact the IGCC office.

Specimens are undamaged and suitable for test (write YES or NO)

- | | | | |
|----------|----------|-----------|-----------|
| 1. _____ | 5. _____ | 9. _____ | 13. _____ |
| 2. _____ | 6. _____ | 10. _____ | 14. _____ |
| 3. _____ | 7. _____ | 11. _____ | 15. _____ |
| 4. _____ | 8. _____ | 12. _____ | |

Mark on specimens (Inspectors Paper Label):

IGCC ® _____		GCIA	
Date _____	Inspector No. _____	Y	N

Information on Permanent Label: _____

NOTICE: IGCC will not be financially responsible for any testing started prior to authorization to test being given by the IGCC Administrative office.

Notice received at IGCC _____



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IGCC LABORATORY MONTHLY STATUS REPORT AND AUTHORIZATION TO TEST

NOTE: This form is to be updated and sent to the IGCC Administrative Office on or before the 10th of each month.

IGCC NUMBER: 1234 F22 DATE: _____

LICENSEE NAME: ABC Glass, Inc. _____

PLANT LOCATION: Anytown, NY INVOICE AMOUNT: \$\$\$\$

TEST METHOD: E2190 INVOICE NO.: ####

DATE SPECIMENS FABRICATED: ###/###/2022 INVOICE DATE: ##/##/2022

DATE AUTHORIZED TO TEST: _____ BY _____ TEST LAB. ###

RECEIVED BY LABORATORY: _____ Laboratory Name
 123 Testing Street, Suite A
 Sackets Harbor, NY

DATE TEST STARTED: _____

Estimated Test Start Date: _____ Estimated Test Completion Date: _____ Job #: _____

Specimen No.	Initial Dew/Frost Point	Initial Gas Content	After 3 Weeks HH	Gas Content After HH	After 9 Weeks AW	Gas Content After AW	After 4 Weeks HH	Volatile Fog Test			Final Gas Content	Comments
								Day 1	Day 2	Day 7		
Date												
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
Requirement		≥90%	<40	N/A	<40	N/A	<40		No Fog		≥80%	

Test data and corresponding test dates on this form are from the designated testing laboratory and are not independently reviewed or verified by the Administrative office. Please review the entire status report for accuracy.

Credibility in Certification through Active Public Participation

ID-160 3/31/2021





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IGCC®/IGMA® Guidance Summary Sheet	
Billing	Lab should bill IGCC Administrative Office for Test Fees. IGCC®/IGMA® is Lab’s client. IGCC®/IGMA® office will provide authorization to begin testing.
Unit Receipt	“Notice of Test Specimen Fabrication” sheets shall be completed and returned to Administrative Office when sample units are received. * Unless waived by participant, test shall not start sooner than 4 weeks from fabrication date.
Authorization/ Status Reports	“Laboratory Monthly Status Report and Authorization to Test” will be signed and dated by Administrator to authorize the testing of samples. These forms are to be used for monthly status reports and returned to the Administrative office by the 10th of each month. The Received date, estimated start and completion date must be included on the forms.
Final Report	Final test reports are to be sent to the Administrative Office no later than 30 days from completion of the testing.
Retention of Samples	Passing samples are to be kept for 30 days from the date of final test report. Non-compliant samples should be kept for 90 days from the date of the final test report.

<i>Under normal circumstances, all units should be the same spacer/glass/airspace.</i>	
Number of Units (Double/Triple)	Test Performed
10 (<i>ASTM E2190-10 ref's 9</i>)	Initial Gas Test
6/6	Weathering test (HH & AW); initial, between phases, and final gas test
3/5 = Shipped 2/4 = Tested	Fog Test – Baseline without IC (Internal Components) units (results used for RAC PC Test – if applicable)
2	Extra – for initial gas test and thermal breakage – if applicable
2	Extra – for initial gas test and shipping breakage – if applicable
Total 13/15 (<i>ASTM E2190-19 ref's 12/14</i>)	Total sample set for normal ASTM E 2190 Durability and Gas Testing

RAC Provisional Certification Testing- if applicable	
Number of Units (Double/Triple)	Test Performed
6 (<i>RAC Standard Test Method</i>)	Initial Gas & Durability Test
6/6	Rapid Chamber Assessment Testing; initial, final gas & frost point test
2	Extra- for shipping breakage only- if applicable (not to be used for failures)
Total 6/6 (<i>RAC Standard Test Method</i>)	Total sample set for RAC Testing